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THESIS

A COMPARATIVE ANALYSIS OF THE ARMY MQ-8B FIRE SCOUT VERTICAL TAKEOFF UNMANNED AERIAL VEHICLE (VTUAV) AND NAVY MQ-8B MANPOWER & TRAINING REQUIREMENTS

by

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March 2009

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The recent increased urgency to combat terrorism and asymmetric threats, combined with the environment in which field troops are forced to operate has created a unique demand for non-standard war fighting capabilities. Beginning in 2004, the U.S. Navy, in a joint effort with the U.S. Army, began jointly testing and evaluating the Northrop Grumman MQ-8B Fire Scout Vertical Take Off Unmanned Aerial Vehicle (VTUAV). This platform has shown very promising early results in testing and is slated for implementation on the Navy's newest Littoral Combat Ship (LCS).

A manpower analysis of the Fire Scout MQ-8B was conducted to identify requirements applicable to operating the platform aboard LCS. Current Army MQ-8B manning was described and used to compute a baseline model determining best mix of manpower requirements needed to implement Fire Scout at sea. Accurate identification of manpower requirements and training for Fire Scout operators, technicians and support personnel will eventually diminish reliance on civilian contractors, and provide the opportunity for joint military operability. The Army MQ-8B Fire Scout training program was analyzed to compare the suitability and feasibility of Navy training for operators and technicians. Currently, there is no Navy training program in place to train Fire Scout operators and technicians to support LCS.

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I. INTRODUCTION

A. AREA OF RESEARCH

This research analyzed the manpower and training requirements for operation of the MQ-8 Fire Scout Vertical Takeoff Unmanned Aerial Vehicle (VTUAV) aboard the Littoral Combat Ship (LCS). Emphasis was placed on the similarities of the Army Manpower Structure for operation of the Army MQ-8B Fire Scout. The research reviewed and described the current Army manpower structure of an MQ-8B Fire Scout platoon as well as training and qualification requirements to determine suitability and potential value in development of a Navy training program.

B. RESEARCH QUESTIONS

1. Primary Questions

- What is the current Army manpower and training structure for the MQ-8B Fire Scout VTUAV?
- What is the proposed Navy Rate and Rank structure for the MQ-8B Fire Scout VTUAV?

2. Secondary Questions

- What are the operator training requirements for the MQ-8B Fire Scout?
- What is the feasibility of a joint Army/Navy training program?

C. DISCUSSION

Since the dawn of aviation, more than 100 years ago, militaries throughout the world have continuously pursued the development of unmanned aerial vehicles to give them an edge over the enemy when conducting combat operations. Following initial development of various UAVs in the 1990s, their use in the global war on terror has increased tenfold, including increasing capability to provide detailed and longer-term reconnaissance for almost all combat operations.

As a joint Army-Navy program, the MQ-8B Fire Scout is now being tested and developed by both services. The Army joined a Navy buy and purchased its first eight airframes, which are now being integrated at Moss Point, Miss. The electronic systems onboard include synthetic aperture radar, electro-optical sensors, multi-spectral imaging and laser designation technology. Planned weapons systems include choices of Hellfire laser guided missiles, two packs of four 70mm (2.75 inch) Hydra rockets, advanced precision kill weapon system laser guided rockets or two Northrop Grumman Viper Strike precision munitions. Viper Strike has a global positioning system (GPS) guidance and semi-active laser seeker.[1]

D. BENEFITS OF THE STUDY

Unmanned Aerial Vehicles are rapidly becoming the force multiplier of future militaries. Determining the manpower requirements necessary to operate and repair these aircraft is imperative to successful development of a capable UAV program, specifically the MQ-8B Fire Scout. Without proper analysis of requirements and development of a training pipeline, the services will continue to rely upon civilian contractors for program success.

E. SCOPE

The scope of this research included: (1) An analysis of Army manning requirements to operate a Fire Scout unit; (2) A review of planned training programs for operators and maintainers of the MQ-8B Fire Scout and the feasibility of a joint forces training program; (3) An identification of manning requirements for the MQ-8B Fire Scout.

[1] Fire Scout MQ-8B Vertical Take-off and Landing Tactical Unmanned Aerial Vehicle, accessed February 2009, available from the World Wide Web @ http://www.army-technology.com/projects/firescout/.

F. METHODOLOGY

The methodology used in thesis research included the following:

- A review of all applicable reference information resources was conducted, including books, magazine articles, periodicals, internet articles and personal interviews.
- The Army UAV manpower organization was reviewed and analyzed.
- Navy manpower requirements for the MQ-8B Fire Scout were comparatively addressed, analyzed and proposed.
- The Army training program for operators and technicians was described and compared in terms of suitability for potential Navy operator training and/or joint training.

G. THESIS ORGANIZATION

Chapter I states the primary purpose of the research and discusses the importance of the development of manpower and a training program for MQ-8B operators and technicians through primary and secondary research questions.

Chapter II provides a thorough description of the MQ-8B Fire Scout specifications, potential uses and payload capability.

Chapter III provides a review of the planned Army Fire Scout platoon, including rank and specialty codes.

Chapter IV includes the Navy Enlisted Classification (NEC) and Source Ratings for UAVs, as well as a brief summary of each.

Chapter V provides a summary of findings and conclusions, and presents recommendations to the Navy on developing formal manpower requirements and potential training programs.

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II. SPECIFICATIONS AND HISTORY OF MQ-8B FIRE SCOUT

A. OVERVIEW OF VTUAV IN THE NAVY

1. History

Vertical Takeoff Unmanned Aerial Vehicles (VTUAVs) are not a new concept to the Navy. In the 1950s, the Soviet submarine force was becoming increasingly ominous in both size and capability. The U.S. Navy sought to develop a way to counter the threat of submarines before they were able reach striking distance of surface ships and began development of the Drone Anti-Submarine Helicopter (DASH) weapon system. The concept was designed to use an unmanned, remotely controlled helicopter to deliver an anti-submarine torpedo from a surface based ship before the submarine was able to reach striking distance. On December 7, 1960, the first unmanned takeoff and landing of a helicopter, a QH-50A, was made aboard the USS Hazelwood (DD-531) while underway at sea. This historic event proved that unmanned vertical launch and recovery from a moving vessel was plausible. The ability to deliver ordnance using such platforms was well within the grasp of the U.S. Navy. Check the alignment all the way through

In subsequent operational evaluations off of Key West, Florida, 38 flights were made from the Hazelwood and 22 simulated Anti Surface Warfare (ASW) missions were conducted confirming the feasibility of the DASH weapon system. The Hazelwood would later be converted as the trial ship for DASH development.

2. Demise of DASH Program

By late 1969, the DASH program began to be phased out, under the direction of Secretary of Defense McNamara. The DASH program was removed from FRAM destroyers as they returned to their home ports for overhaul work. On the destroyer CHEVALIER (DD-805), for example, the DASH hangar was converted into an overhead display in the crews lounge with fake wood paneling and a suspended ceiling covering the overhead florescent lights. The only problem with this installation was that it was

installed with pop-rivets. The first time CHEVALIER fired its five-inch guns, the entire hangar lounge was destroyed when the ceiling crashed down and most of the paneling fell off. The DASH hangar was eventually transformed into a storage room for items that the crew purchased in foreign ports.

The DASH program was under constant scrutiny from Naval Aviators who felt that an unmanned aircraft would eventually replace manned aircraft. By direction of Secretary of Defense McNamara, all U.S. Navy DASH program operations ended on November 30, 1970. [2]

Figure 1. QH-50A departs from USS Hazelwood, December 7, 1960[1]

[2] DASH history, The DASH Weapon System, accessed January 2009, available from World Wide Web @http://www.gyrodynehelicopters.com/dash_history.htm.

B. FIRE SCOUT DEVELOPMENT

1. RQ-8B Development

Schweizer Aircraft, well known for the production of non-powered FAA certified gliders, has designed and built aircraft for over fifty years. In 1986, the Schweizer company acquired from McDonnell Douglas the production and manufacturing rights to the Hughes 300 helicopter, which it had been building under license since 1983. In 1987, Schweizer announced it was developing an improved turbine powered version of the Hughes 300 model, the Schweizer 330. The 330 was designed to fulfill a variety of roles including utility, law enforcement, observation, patrol, photography, transport, agricultural and training. The first deliveries of the Schweizer 330 took place in mid 1993.[3]

Figure 2. Schweizer 330 helicopter[4]

[3] The Schweizer 330, accessed January 2009, available from the World Wide Web @http://www.airliners.net/aircraft-data/stats.main?id=349.

[4] Schweizer 330 photo, accessed January 2009, available from the World Wide Web @http://www.aso.com/i.aso3/.

2. VTUAV Transition

It is from this basic, yet proven platform that the RQ-8B Fire Scout VTUAV was developed. The Fire Scout is powered by a derated version of the proven Rolls-Royce Allison 250C20 turboshaft engine. While capable of producing 315KW (420 Shaft Horsepower (shp)), the engine has been governed to produce just 175KW (235shp) for takeoff and 165KW (220shp) for max continuous operation driving a three blade main rotor and two blade tail rotor. Derating the engine increases the performance of the aircraft at higher altitudes and higher than standard (59 degrees Fahrenheit) temperatures. Furthermore, by derating the engine, fuel burn rate is decreased and both on-station time and maintenance intervals are increased. Under testing, the power plant was able to develop maximum rated output power from sea level to the lower level of class Alpha Airspace at 18,000 feet. As opposed to the majority of UAVs currently being used by the military which are fueled by 100 Octane Low Lead Aviation Gas (AVGAS), the Fire Scout was developed to run on Jet Propellant 5 and 8 (JP-5 and JP-8 jet fuel). Both fuels are a kerosene-based derivative of diesel fuel, which are relatively nonvolatile with a much higher flashpoint than commercial aviation turbine fuels and far safer than AVGAS for shipboard use. In addition, both fuels contain an icing inhibitor, corrosion inhibitor, lubricants and antistatic agents, making them ideal for prolonged operation in sometimes less than ideal conditions.

Figure 3. RQ-8A Fire Scout lands aboard USS Nashville[5]

[5]Autonomous Fire Scout UAV lands on ship, accessed January 2009, available from the World Wide Web @ http://www.spacewar.com/reports/Autonomous_Fire_Scout_UAV_Lands_On_Ship.html.

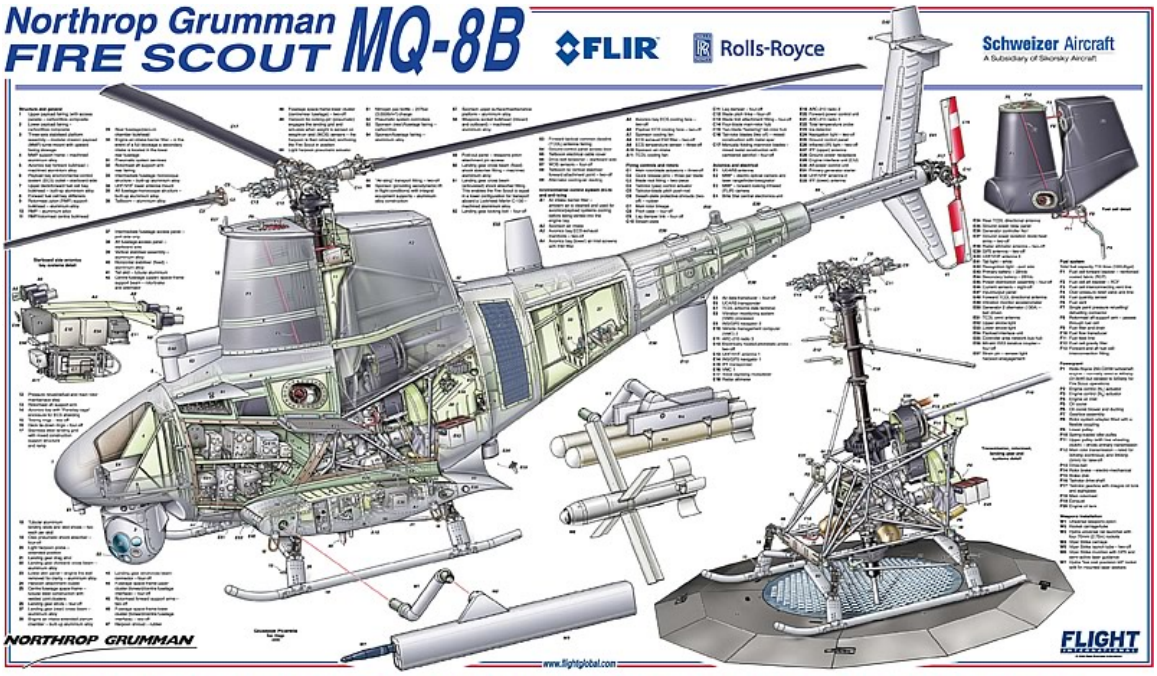
On January 16, 2006 at 2:42 pm, an RQ-8A Fire Scout landed aboard the U.S. Navy warship USS Nashville (LPD 13) off the coast of Maryland. "This event has provided much-needed data for how autonomous systems will operate in the future." said Capt. Paul Morgan, Unmanned Aerial Systems (UAS) program manager. "This is the bedrock of future autonomous systems, of which VTUAV is the forerunner. We gather data every time this system flies, and are on the downward slope of the learning curve. This is an exciting time."[6]

During subsequent landing tests, the USS Nashville traveled at speeds of up to 17knots with several uneventful landings, using Unmanned Common Automatic Recovery System (UCARS) precision landing system.

3. MQ-8B Evolution

Although progress on the project had been regarded as satisfactory, the Navy decided the Fire Scout did not meet their needs and cut funding for production in December 2001. However, the development program continued, and Northrop Grumman pitched a range of improved configurations to anyone who was interested. The U.S. Army remained extremely interested, awarding a purchase contract to Northrop Grumman for seven improved RQ-8B evaluation machines in late 2003. In 2005, the Fire Scout was redesignated MQ-8B with minor changes and revisions, creating a far better platform.

[6] Autonomous Fire Scout UAV lands on ship, accessed January 2009, available from the World Wide Web @ http://www.spacewar.com/reports/Autonomous_Fire_Scout_UAV_Lands_On_Ship.html.



Defense Industry Daily subscribers can download the full bandwidth-intensive 655 kb picture; a link can be found near the beginning of the protected subscriber section. We regret the necessity, but bandwidth costs would be a problem otherwise. Interested individuals can also get this picture as an Acrobat file from Northrop Grumman:

http://www.is.northropgrumman.com/systems/system_pdfs/MQ-8B_FireScout_Cutaway_WEB.pdf

Figure 4. Northrop Grumman MQ-8B exploded view[7]

The MQ-8B features a smaller diameter four-blade main rotor, in contrast to the larger-diameter three-blade rotor of the RQ-8A. In addition to requiring less storage space, the smaller rotor reduces noise and improves lift capacity and performance. Gross takeoff weight is increased by 500 pounds to 3,150 pounds, with payloads of up to 700 pounds for short-range missions. With a light load of 130 pounds, the MQ-8B endurance is over eight hours. The MQ-8B is fitted with stub wings that will serve an aerodynamic purpose as well as an armament carriage location. Planned weapons systems include choices of Hellfire laser guided missiles, two packs of four 70mm (2.75 inch) folding-fin Hydra rockets, advanced precision kill weapon system laser guided rockets or two Northrop Grumman Viper Strike precision munitions. Viper Strike uses a global

[7] Defense Industry Daily, The Fire Scout VTUAV program: By Land and By Sea (updated), accessed January 2009, available from the World Wide Web @ http://www.defenseindustrydaily.com/images/AIR_MQ-8B_Cutaway_from_NGC_lg.jpg.

positioning system (GPS) guidance and semi-active laser seeker. The Army views this versatile weapons package as ideal for the modernn battlefield. In addition to its use as an armed platform, the Fire Scout can also be used to transport up to 200 pounds of emergency supplies to troops in the field.

Figure 5. MQ-8B Fire Scout with Forward-looking Infrared Radar pod installed[8]

Due to the continued success of the Fire Scout testing and visionary uses of the Army, the Navy interest was revived. This became evident in August 2006, when the U.S. Navy awarded Northrop-Grumman a $136 million modification contract to complete the Vertical Take-off and Landing Tactical Unmanned Air Vehicle (VTLTUAV) System Development and Demonstration (SDD) phase through 2008. A total of nine MQ-8B Navy Fire Scouts were planned to be built under the SDD phase. In February 2007, the U.S. Navy ordered two more aircraft at a per unit production cost of $15 million.[9]

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[8] Northrop Grumman, MQ-8B Fire Scout Vertical Takeoff Unmanned Aerial Vehicle, accessed January 2009, available from the World Wide Web @http://www.irconnect.com.

[9] Fire Scout MQ-8B Vertical Take-Off and Landing Tactical Unmanned Aerial Vehicle, accessed February 2009, available on the World Wide Web @ http://www.army-technology.com/projects/firescout/.

4. Platform Specifications

General characteristics

- **Crew:** 0
- **Length:** 22.87 ft in (7 m)
- **Main rotor diameter:** 27 ft 6 in (8.4 m)
- **Height:** 9.42 ft in (2.9 m)
- **Gross weight:** 3,150 lb (1,430 kg) each
- **Payload:** 700 lb

Performance

- **Cruise speed:** 125+ mph (201+ km/h)
- **Endurance:** 8 hours
- **Service ceiling:** 20,000 ft (6,100 m)

Propulsion System

- **One 315KW (420shp) Allison 250C20W turboprop derated to 175KW (235shp) for takeoff and 165KW (220shp) for max continuous operation**

Payload Options

- Food and supplies
- Real time Intelligence, Surveillance and Reconnaissance (ISR) imagery, communications and targeting equipment
- Hellfire laser guided missiles
- Two pods of four 70mm (2.75inch) folding-fin Hydra rockets
- Advanced Precision Kill Weapons System laser guided rockets
- Viper Strike precision Munitions

III. MANPOWER ANALYSIS OF THE ARMY RQ-8B FIRE SCOUT PROGRAM

A. STANDARD ARMY FIRE SCOUT PLATOON

1. General Description

The U.S. Army is currently testing and evaluating the MQ-8B VTUAV Fire Scout using a stand-alone Fire Scout Platoon consisting of just 27 soldiers. The Army, unlike the other branches of service, predominately uses enlisted personnel to operate the VTUAV, which includes the duties of mission planning, mission sensor/payload operations, launching, remotely piloting and recovery of the aerial vehicle.[10] A Future Combat Systems Brigade Combat Team (FBCT) Class IV Unmanned Aerial System (UAS) platoon will consist of the following:

- Thirty-two Unmanned MQ-8B Fire Scout vehicles per FBCT in the Reconnaissance Surveillance and Target Acquisition (RTSA) Squadron;
- Four platoons of eight Unmanned Aerial Vehicles in RSTA Surveillance Troop;
- Eight Launch Control Units (LCU) mounted on Joint Light Tactical Vehicles (JLTV), two per platoon;
- Platoon manning to consist of 27 soldiers, to be described later.

Prime moving platform for the systems is still under research. The proposed platform, Heavy Expanded Mobility Tactical Truck-Load Handling System (HEMTT-LHS) Palletized Load System (PLS) Trailer, did not meet Future Combat Systems (FCS) or Army requirements in present configuration. Four moving platforms are planned per platoon [11] [12]

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[10] Army MOS codes description, accessed January 2009, available from the World Wide Web @ http://usmilitary.about.com/od/enlistedjobs/a/arjobs.htm.

[11] FCS OPERATIONAL REQUIREMENTS DOCUMENT Version 2.0 AUG 07 FBCT Unit Reference Sheet (URS) 25 SEP 06, FCS Operational & Organizational (O&O) document.

[12] Personal knowledge of the Army UAS gained through experience and various briefings (Kenneth O. Kolbeck SFC USA TCM FCS UMS Team UAS SME).

2. Manning Requirements

To understand manning requirements, Military Occupational Specialty Codes (MOSC) are briefly explained. The MOS code (MOSC) consists of nine characters and provides more defined information than a soldier's MOS. The MOS is used in automated management systems and reports. The MOSC is used in active and reserve records, reports, authorization documents, and other personnel management systems.

The elements of the MOSC are as follows:

First three characters: The MOS. The first two characters are always a number; the third character is always a letter. The two-digit number is usually (but not always) synonymous with the Career Management Field (CMF). For example, CMF 11 covers infantry, so MOS 11B is "Rifle Infantryman." Among the letters, "Z" is reserved for "Senior Sergeant" (E-8), such that 11Z is "Infantry Senior Sergeant"

The fourth character of the MOSC represents skill level (commensurate with rank and grade):

- 0 is used to identify personnel undergoing training for award of a primary MOS (PMOS).
- 1 identifies a Private (PVT) through Specialist (SPC) or Corporal (CPL) (E1 – E4 paygrade)
- 2 identifies a Sergeant (SGT) (E5 paygrade)
- 3 identifies a Staff Sergeant (SSG) (E6 paygrade)
- 4 identifies a Sergeant First Class (SFC) (E7 paygrade)
- 5 identifies a Master Sergeant (MSG), First Sergeant (1SG), Sergeant Major (SGM) or Command Sergeant Major (CSM). (E8-E9 paygrade)

Fifth character: A letter or number and a special Qualification identifier (SQI). It may be associated with any MOS unless otherwise specified. Soldiers without any special SQI are assigned the SQI "O" (oscar), often confused as a zero.

Sixth and seventh characters: An additional skill identifier (ASI). They are an alphanumeric combination and may only be associated with specified MOSs, although in

practice some ASIs are available to every MOS (e.g. ASI P5 for "master fitness trainer"). Soldiers without any ASIs are assigned the default ASI "00" (zero-zero).[13]

Eighth and ninth characters: Two-letter requirements and qualifications, which are a language skill identifier (LSI). Soldiers without a language skill are assigned the default LSI "OO" (Oscar-Oscar). LSI codes can be found in AR 611-6.

The Army's planned manning requirements consist of four platoons, each comprised of 27 soldiers. In 2005, the Army established Military Occupational Specialty (MOS) 15W which deleted MOS 35K (Military Intelligence) and combined all Unmanned Aerial Vehicle Operator MOS's, regardless of platform.[14] The MOS for Maintainers will be a 15E, but at the current time, no such specialty code has been published. When developed later in 2009, the MOS will be populated with 15J Aircraft Armament / Missile Systems Soldiers. A brief description is provided below:

MOS 15W - Unmanned Aerial Vehicle (UAV) Operator (UAV Operator), Career Management Field (CMF) 15

Major duties. The UAV operator supervises or operates the UAV, to include mission planning, mission sensor/payload operations, launching, remotely piloting and recovering the aerial vehicle. Duties for MOS 15W at each skill level are:

> **Skill Level 1** MOSC 15W1O. Prepares and conducts air reconnaissance mission. Operates mission sensor/payload for target detection. Plans and analyzes flight missions. Deploys and redeploys the TUAS ground and air system. Operates and performs operator level maintenance on communications equipment, power sources, light and heavy wheel vehicle and some crane operations. Launches and recovers the air vehicle, performs pre-flight, in flight and post-flight checks and procedures.

[13] Army Regulation 611-6, Military Occupational Classification Structure Development and Implementation, accessed February 2009, available on the Word Wide Web @ http://www.army.mil/usapa/epubs/pdf/r611_1.pdf.

[14] Information Paper, MOS 15W Unmanned Aerial Vehicle (UAV) Operator, Aviation Proponency Office.

Skill Level 2 MOSC 15W2O. Directs emplacement of ground control station. Directs emplacement of launch and recovery systems. Supervises and assists in air frame repair. Coordinates evacuation and replacement of parts and end items.

Skill Level 3 MOSC 15W3O. Performs duties shown in preceding skill level and provides guidance to subordinate soldiers, Supervises site selection of UAS ground equipment using maps, aerial photographs, terrain studies and intelligence reports. Assists in coordination of intelligence collection. Recommends methods of employment to higher and adjacent units. Maintains mission and operational data base.

Skill Level 4 MOSC 15W4O. Performs duties shown in preceding skill level and provides guidance to subordinate soldiers. Supervises and coordinates platoon operations. Applies military intelligence collection process and surveillance planning to UAS operations. Coordinates shift operations for platoon.

Skill Level 5 MOSC 15W5O. Performs duties shown in preceding skill level and provides guidance to subordinate soldiers. Assists commander in site selection and coordinates functions of various platoons within the UAS Company. Supervises area security. Supervises and operates specialized surveillance equipment for target identification.

MOS 15E - Unmanned Aerial Systems (UAS) Maintainer (UAS Maintainer), Career Management Field (CMF) 15

Major duties: UAS Maintainer is responsible for all repairs, modifications and preventative maintenance directly related to UAS. No formal job description for 15E has been established. Duties commensurate with each skill level have not been developed. The initial 15E maintainers will be pulled from 15J Aircraft Armament/Missile Systems Repairers and formally trained on UAS Maintenance practices. Within the next few years, a final 15E MOS is expected.

Rank and Manning Structure

- Rank structure is designed to have one Commissioned Officer (or Warrant Officer), one Warrant Officer and 25 enlisted soldiers, each explained below.
- One Platoon Leader, paygrade O-2 (proposed change to W3 Warrant Officer Unmanned Aerial System Platoon Leader)
- One Unmanned Aerial System Technician, paygrade W2
- One 15W Platoon Sergeant, paygrade E-7
- Four 15W Unmanned Aircraft Crewmember (UAC) Squad Leader, paygrade E-6
- Four 15W UAC Team leader, paygrade E-5
- Six 15W UAC, paygrades E-1 to E-4
- Four 15E Unmanned Aerial Systems (UAS) Repairer Maintenance Supervisor, paygrade E-5
- Six 15E Maintainers, paygrade E-1 to E-4

Table 1. ARMY MQ-8B Manpower Breakdown

QTY	MOS	PAYGRADE	TITLE
1	15*	O2	PLATOON LEADER
1	15*	W2	UNMANNED AERIAL SYSTEM TECHNICIAN
1	15W4O	E7	PLATOON SERGEANT
4	15W3O	E6	UNMANNED AIRCRAFT CREWMEMBER (UAC) SQUAD LEADER
4	15W2O	E5	UAC TEAM LEADER
6	15W1O	E1-E4	UNMANNED AERIAL CREWMEMBER (UAC)
4	15E2O	E5	UNMANNED AERIAL SYSTEMS (UAS) REPAIRER MAINTENANCE SUPERVISOR
6	15E1O	E1-E4	UAS MAINTAINERS

* Any 1500 series MOS

3. Training Programs

All 15W UAS operators and 15E UAS maintainers will be enlisted Soldiers. Training for UAS operators (15W) will be approximately six months at Fort Huachuca, Arizona. The Plan of Instruction (POI) for Future Combat Systems (FCS) is currently under development. Unmanned Aerial System Maintainer (15E) training will begin in 2009 at Fort Huachuca, based on the current Unmanned Aerial Systems RQ-7B Shadow, MQ-5B Hunter and Extended Range Multi Purpose (ERMP) UAV training curriculum, which has been taught since 1992. The curriculum will continue to be based on Army Regulation 95-23 (AR 95-23) [15] The Army Aviation Center at Fort Rucker, Alabama will be the governing authority for all training decisions. [16]

4. Selection Criteria for 15E and 15W MOS

Two main criteria are used for selection of 15E and 15W MOS's. Those two criteria are the Armed Services Vocational Aptitude Battery (ASVAB) test and the Physical Profile Serial System (PULHES) score.

The **Armed Services Vocational Aptitude Battery** (**ASVAB**) is a multiple choice test, administered by the United States Military Entrance Processing Command, used to determine qualification for enlistment in the United States armed forces. It is often optionally administered to American high school students when they are in the 11th grade, though anyone eligible to and interested in enlisting can take it. The ASVAB was first instituted in 1976, and it underwent a revision in 2002. In 2004, the test's percentile ranking scoring system was re-normalized, to ensure that a score of 50% really did represent doing better than exactly 50% of test-takers.[17]

The Army converts the ASVAB subtest scores into 10 composite score areas, known as "line scores." The line scores determine which individuals are qualified for

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[15] Army Regulation AR 95-23.

[16] FCS Operational Requirements Document, Version 2.0, August 2007.

[17] Armed Services Vocational Aptitude Battery, accessed February 2009, available from the World Wide Web@ http://en.wikipedia.org/wiki/ASVAB.

which job(s). The ASVAB subtests are General Science (GS); Arithmetic Reasoning (AR); World Knowledge (WK); Paragraph Comprehension (PC); Numerical Operations (NO); Coding Speed (CS); Auto and Shop Information (AS); Mathematics Knowledge (MK); Mechanical Comprehension (MC); Electronics Information (EI); and Sum of World Knowledge and Paragraph Comprehension (VE).[18] The ASVAB subtests scores are further computed by combining multiple subtest scores to compute the "line scores." The only line score used for selection criteria is the General Technical (GT) score, which is a combination of VE and AR subtest scores.

The **Physical Profile Serial System (PULHES)** is a medical profile indicator, developed by the military, to determine medical standards for different jobs, and to ensure military members are medically qualified to perform assigned duties.

The physical profile serial system is based primarily upon the function of body systems and their relation to military duties. The functions of the various organs, systems, and integral parts of the body are considered. Since the analysis of the individual's medical, physical, and mental status plays an important role in assignment and welfare, the military takes great care in executing the functional grading.

In developing the system, the functions have been considered under six factors designated "P–U–L–H–E–S." Each of these letters stand for a specific medical area:

> (1) P — The "P" in "P-U-L-H-E-S" stands for "Physical capacity or stamina." This factor, general physical capacity, normally includes conditions of the heart; respiratory system; gastrointestinal system, genitourinary system; nervous system; allergic, endocrine, metabolic and nutritional diseases; diseases of the blood and blood forming tissues; dental conditions; diseases of the breast, and other organic defects and diseases that do not fall under other specific factors of the system.

[18] Department of the Army Pamphlet 611-21, Military Occupational Classification and Structure, Headquarters Department of the Army, Washington DC, 22 January 2007.

(2) U — The "U" area is used for "Upper extremities." This factor concerns the hands, arms, shoulder girdle, and upper spine (cervical, thoracic, and upper lumbar) in regard to strength, range of motion, and general efficiency.

(3) L — Lower extremities. This factor concerns the feet, legs, pelvic girdle, lower back musculature and lower spine (lower lumbar and sacral) in regard to strength, range of motion, and general efficiency.

(4) H — Hearing and ears. This factor concerns auditory acuity and disease and defects of the ear.

(5) E — Eyes. This factor concerns visual acuity and diseases and defects of the eye.

(6) S — Psychiatric. This factor concerns personality, emotional stability, and psychiatric diseases.

Four numerical designations are used to reflect different levels of functional capacity. The basic purpose of the physical profile serial is to provide an index to overall functional capacity. Therefore, the functional capacity of a particular organ or system of the body, rather than the defect per se, is evaluated in determining the numerical designation 1, 2, 3 or 4.

For example, if a military job requires a serial profile of "123123," that means, in order to qualify for that job, a person would have to be medically rated a "1" in the area of "Physical capacity or stamina," a medical rating of "2" in the area of "Upper extremities," have a medical rating of "3" in the area of "Lower extremities," a rating of "1" in the area of "Hearing and Ears," etc.

As for the numerical designators, they generally mean a military medical evaluation of:

(1) An individual having a numerical designation of “1” under all factors is considered to possess a high level of medical fitness.

(2) A physical profile designator of "2" under any or all factors indicates that an individual possesses some medical condition or physical defect that may require some activity limitations.

(3) A profile containing one or more numerical designators of "3" signifies that the individual has one or more medical conditions or physical defects that may require significant limitations. For those applying for military service, this designation is duty (i.e., limited duty/assignments)

(4) A profile serial containing one or more numerical designators of "4" indicates that the individual has one or more medical conditions or physical defects of such severity that performance of military duty must be drastically limited. Definitely a disqualifier for both entering the military, and for continued military service, if already in the military.[19]

Recruit training or reclassification training is available to all Soldiers with at least a 110 GT score on the Armed Services Vocational Aptitude and Battery (ASVAB) test and a 112111 PULHES score.[20]

[19] Military Physical Profile System – the PULHES Factors, accessed February 2009, available from the World Wide Web@ http://usmilitary.about.com/od/joiningthemilitary/l/blpulse.htm.

[20] Personal knowledge of the ARMY UAS, gained through experience and various briefings (Kenneth O. Kolbeck, SFC USA TCM FCS UMS Team UAS SME).

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IV. NAVY UAV MANNING STRUCTURE, ENLISTED CLASSIFICATION AND RATE COMPARISON

A. NAVY ENLISTED CLASSIFICATION (NEC) AND RATE DESCRIPTION RELEVANT TO UNMANNED AERIAL VEHICLES (UAV)

1. General Description

To understand the differences and similarities between the Army manpower structure and a proposed Navy structure, the Navy Rate and Navy Enlisted Classification (NEC) systems are briefly described.

The Army, Air Force, and Marines seem to have hundreds of enlisted jobs, while the Navy only has a few (comparatively speaking) ratings. The reason for this is that the Navy uses the Navy Enlisted Classification (NEC) system as a method of further subdividing the standard ratings.

The Army uses the Military Occupational Specialty (MOS) system and the Air Force uses Air Force Specialty Codes (AFSCs) to differentiate between individual enlisted specialties within their respective branches. The NEC system used in the Navy supplements the enlisted rating structure in identifying personnel on active or inactive duty and billets in manpower authorizations. NEC codes identify a non-rating wide skill, knowledge, aptitude, or qualification that must be documented to identify both people and billets for management purposes.

It helps to think of an NEC as an "advanced specialty" within a job. All services use the "advanced specialty within a job" system, in one way or another, but not to the extent that the Navy uses their NEC system. For example, in the Army, "Operating Room Specialist", and "Radiology Specialist" are two separate jobs (MOS 68D and 68P, respectively). The same is true of the Air Force's Air Force Specialty Codes (AFSCs) 4N1X1 and 4R0X1. In the Navy, an operating room specialist and a radiology specialist hold the same rating (job) — that of HM (Hospitalman).

Operating Room Specialist and Radiology Specialist HMs are differentiated by assigning an NEC to designate their advanced specialty. An HM who has received advanced training as a surgical technologist is awarded the NEC of HM-8483 and an HM who has received advanced training as an x-ray technician would be awarded the NEC of HM-8451 or HM-8452. It should also be mentioned that it is possible to hold multiple NEC's simultaneously. [21]

2. Unmanned Aerial Vehicle (UAV) Navy Enlisted Classification (NEC) Descriptions

According to Navy Enlisted Manpower & Personnel Classifications and Occupational Standards, Volume II, Navy Enlisted Classifications, there are four NEC's relevant to UAV's. Each of the four is explained and briefly analyzed below. In order to qualify for the training relevant to receiving each NEC, the Sailor must have a specific Source Rating code. Each Source Rating relevant to the NEC will be explained in the following section.

8361 Unmanned Aerial Vehicle (UAV) System Organizational Maintenance Technician. The holder of an 8361 NEC is responsible for performing organizational level maintenance on UAV systems and support equipment. To receive training relevant to obtaining this NEC, the Sailor must hold a source rating code of one of the following:

- Aviation Electronic, Electrical and Computer Systems Technician (AT)
- Aviation Electrician's Mate (AE)
- Aviation Structural Mechanic – Hydraulics (AM)
- Aviation Support Equipment Technician (AS)

8361 NEC formal training is mandatory and open to qualifying males and females in the paygrades of E3-E7. There are no additional aviation physical requirements associated with this NEC.

[21] Navy Enlisted Classification Codes, accessed Feb 2009, available on the World Wide Web @ http://usmilitary.about.com/od/navynecs/a/necmenu.htm.

8362 Unmanned Aerial Vehicle (UAV) External Pilot. A UAV External Pilot directly controls the flight of the UAV during launch and recovery operations by visual reference to the UAV. To receive training relevant to obtaining this NEC, the Sailor must hold a source rating code of one of the following:

- Aviation Electronic, Electrical and Computer Systems Technician (AT)
- Aviation Electrician's Mate (AE)
- Aviation Structural Mechanic – Hydraulics (AM)
- Aviation Support Equipment Technician (AS)

8362 NEC formal training is mandatory and open to qualifying males only in the paygrades of E4-E6. This NEC is not open to females. All potential applicants must pass a flight physical prior to training commencement in accordance with aeromedical reference and waiver guide and NAVMED P117. In addition, a Class Two Aviation Flight Physical is required.

8363 Unmanned Aerial Vehicle (UAV) Internal Pilot. A UAV Internal Pilot operates and navigates UAV during the enroute, mission and return phases of flight. To receive training relevant to obtaining this NEC, the Sailor must hold a source rating code of one of the following:

- Aviation Electronic, Electrical and Computer Systems Technician (AT)
- Aviation Electrician's Mate (AE)
- Aviation Structural Mechanic – Hydraulics (AM)
- Aviation Support Equipment Technician (AS)
- Aviation Maintenance Administrationmen (AZ)

8363 NEC formal training is mandatory and open to qualifying males only in the paygrades of E4-E6. This NEC is not open to females. There are no additional flight physical requirements specified.

8364 Unmanned Aerial Vehicle (UAV) Payload Operator. A UAV Payload Operator is responsible for operation of the Electro-Optical/Infra-Red (EO/IR) UAV sensor during all phases of flight. To receive training relevant to obtaining this NEC, the Sailor must hold a source rating code of one of the following:

- Aviation Electronic, Electrical and Computer Systems Technician (AT)
- Aviation Electrician's Mate (AE)
- Aviation Structural Mechanic – Hydraulics (AM)
- Aviation Support Equipment Technician (AS)
- Aviation Maintenance Administrationmen (AZ)
- Intelligence Specialist (IS)

8363 NEC formal training is mandatory and open to qualifying males only in the paygrades of E4-E6. This NEC is not open to females. There are no additional flight physical requirements specified.[22]

3. Definitions of Qualifying UAV Source Ratings

AT — Aviation Electronic, Electrical and Computer Systems Technician: AT's work with some of the most advanced electronics equipment in the world and repair a wide range of aircraft electrical and electronic systems. Repair jobs can range from trouble-shooting the computer-controlled weapons system on an F/A18 Hornet on the flight deck of an aircraft carrier to changing circuit cards or tracing electrical wiring diagrams in an air-conditioned shop. Most of these technicians are trained in computers to support state-of-the-art equipment or on power generators and power distribution systems to support aircraft electrical systems. To qualify for an AT rating, a minimum ASVAB composite score of 222 is required, computed through the following calculations: AR+MK+EI+GS=222 or VE+AR+MK+MC=222. A High school diploma or equivalent qualification is required as well as the ability to type 40 words per minute. No record of conviction by civil court for any offense other than minor traffic is allowed in order to qualify for the required Secret Security Clearance.

AE – Aviation Electrician Mate: AEs are aircraft electricians. They maintain a wide range of electrical and navigational equipment in aircraft including power generators, power distribution systems, lighting systems, flight instrument and fuel

[22] Navy Enlisted Manpower & Personnel Classifications & Occupational Standards, Volume II, Navy Enlisted Classifications (NEC), NAVPERS 18068F, January 2004.

systems, temperature and pressure indicating systems. AEs are also trained in computers to support this state-of-the-art equipment. To qualify for an AE rating, a minimum ASVAB composite score of 222 is required, computed through the following calculations: AR+MK+EI+GS = 222 OR VE+AR+MK+MC=222.

Duties performed by AEs include:

- testing, installing and maintaining a wide range of aircraft instruments and electrical equipment including generators, motors and lighting systems
- reading electrical system diagrams
- maintaining aircraft compass systems
- performing electrical troubleshooting operations
- using a variety of electrical measuring equipment
- performing micro-mini module repair; maintaining automatic flight control systems
- maintaining inertial navigation systems
- performing as aircrew on various aircraft

Qualifications for an AE rating include:

- Vision must be correctable to 20/20
- Must have normal color perception
- Must be a U.S. Citizen
- No history of drug abuse
- Secret Security Clearance

AM – Aviation Structural Mechanic – Hydraulics: AMs maintain aircraft main and auxiliary hydraulic power systems, actuating subsystems and landing gear. AMs are also responsible for maintenance on the aircraft fuselage (mainframe) wings, airfoils, associated fixed and moveable surfaces and flight controls. To qualify for an AM rating, a minimum ASVAB composite score of 210 is required, computed through the following calculations: VE+AR+MK+AS = 210 OR VE+AR+MK+MC = 210.

The duties performed by AMs include:

- Maintain aircraft landing gear system, brakes and related pneumatic systems, reservoir pressurization, emergency actuating devices, pumps, valves, regulators, cylinders, lines and fittings
- Service pressure accumulators, emergency air bottles, oleo struts, reservoirs and master brake cylinders
- Inspect, removes and replace components of hydraulic systems
- Replace gaskets, packing, and wipers in hydraulic components
- Remove, repair and replace aircraft fuselage, wings, fixed and movable surfaces, airfoils, regular seats, wheels and tires, controls and mechanisms
- Remove, install and rig aircraft flight control surfaces
- Fabricate and assemble metal components and make minor repairs to aircraft skin
- Install rivets and metal fasteners
- Paint
- Weld
- Fabricate repairs for composite components
- Perform non-destructive dye penetrant inspections (NDI)
- Perform daily, preflight, post-flight and other periodic aircraft inspections

Qualifications for an AM rating include:

- Vision must be correctable to 20/20
- Must have normal color perception
- Must have normal hearing
- Must be high school graduate
- No history of drug abuse
- Secret Security Clearance not required unless serving on Aircrew Duty

AS – Aviation Support Equipment Technician: ASs operate, maintain, repair and test automotive electrical systems in ground equipment, gasoline and diesel systems, and associated automotive, hydraulic and pneumatic systems. They also maintain gas turbine compressor units, ground air-conditioning units, perform metal fabrication, repair

and painting of tow tractors and other aircraft servicing units. To qualify for an AS rating, a minimum ASVAB composite score of 210 is required, computed through the following calculations: VE+AR+MK+AS=210 OR VE+AR+MK+MC=210

Qualifications for an AS rating include:

- Must have normal color perception
- Secret Security Clearance not required

AZ – Aviation Maintenance Administrationmen: AZs perform a variety of clerical, administrative, and managerial duties necessary to keep aircraft maintenance activities running efficiently. The rating requires close communication with all other aviation maintenance ratings. To qualify for an AZ rating, a minimum ASVAB composite score of 102 is required, computed through the following calculations: VE + AR = 102

The duties performed by AZs include:

- scheduling aircraft inspections
- keeping charts that show trends in aircraft system reliability
- organizing and operating libraries of technical publications, reports and related maintenance data
- issuing aircraft inspection and work orders
- performing clerical and administrative duties such as filing and typing
- preparing reports and correspondence
- performing computer data base and system analysis
- maintaining engine logbooks and associated aircraft records

Qualifications for an AZ rating include:

- Must be a U.S. Citizen
- Secret Security Clearance required

IS – Intelligence Specialist: Military information, particularly classified information about enemies or potential enemies, is called "intelligence." Intelligence specialists analyze intelligence data. They break down information to determine its

usefulness in military planning. From this intelligence data, they prepare materials that describe in detail the features of strategic and tactical areas all over the world. To qualify for an IS rating, a minimum ASVAB composite score of 107 is required, computed through the following calculations: VE+AR=107

The duties performed by ISs include:

- Analyzing intelligence information
- Identifying and processing intelligence from raw information
- Assembling and analyzing multisource operational intelligence
- Preparing and presenting intelligence briefings
- Preparing planning materials for photographic reconnaissance missions and analyzing the results
- Preparing reports, graphics, overlays and mosaics
- Plotting imagery data using maps and charts
- Providing input to and receiving data from computerized intelligence systems ashore and afloat
- Maintaining intelligence libraries and files [23]

B. NAVY TRAINING SYSTEM PLAN FOR THE VERTICAL TAKEOFF AND LANDING TACTICAL UNMANNED AERIAL VEHICLE

1. Operational Concept

The VTUAV systems will be operated and maintained by both Officers and Enlisted personnel in the Navy. When required, individual detachments or partial VTUAV systems will be combined to support protracted operations or to meet high demand tasking afloat or ashore. A single VTUAV system will be capable of providing 12 continuous hours on-station at 110 nautical mile range within a 24-hour period.

All operators will be trained as Mission Commanders (MC) and Air Vehicle Operators (AVO) under OPNAV instruction 3710.7 with qualification and certification

[23] Navy Rate Structure, accessed Feb 2009, available on the World Wide Web @www.usmilitary.about.com.

managed by the individual's parent squadron. For enlisted trained as both Pilot and Payload Operator, the term Air Vehicle Operator (AVO) will be used. Two shipboard mounted workstations will be used for command and control of the VTUAV. The first station will be operated by the Mission Payload Operator (MPO), MC or AVO (enlisted pilot). The second station will be operated by the AVO. Navy manpower is projected to require three officers and three enlisted personnel per system to meet requirements on a watch standing basis. [24]

- Mission Commander, Designator 1302
- Air Warfare Qualified Officer
- Formal Training relevant to UAV operation
- UAV Air Vehicle Operator, NEC 83XA
- Primary NEC
- Formal Training
- E5-E7 paygrades
- Source Ratings – Any enlisted aviation rating E5 or above
- Naval Air Training and Operating Procedures Standardization (NATOPS) qualified
- Air Intercept Controller (AIC) certified

Table 2. Navy Watch-Standing Proposed Manpower Requirements

QUANTITY	RATE/DESIGNATOR	TITLE
3	Officer (1302 designator) or dual qualified Enlisted E5-E7	Mission Payload Operator (MPO) (Mission Commander (MC) or Air Vehicle Operator (AVO)
3	E5-E7, Any	Air Vehicle Operator (AVO)

[24] Navy Training System Plan for the Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle, N75-NTSP-A-50-0004/D, June 2001.

2. Maintenance Concept

Maintenance will be performed by Navy personnel with skills resident within the Aviation Machinist's Mate (AD), Aviation Electrician's Mate (AE), Aviation Structural Mechanic (AM), Aviation Electronics Technician (AT), Electronics Technician (ET) and Fire Controlman (FC) ratings. The preliminary estimate for manpower requirements of Navy maintenance is five ADs, four AEs, four AMs, four ATs, one AZ and one maintenance Chief Petty Officer for a total of nineteen. The decision to utilize ET and FC ratings is pending.

- UAV System Technician, NEC 83XB
- Primary NEC
- Formal training
- E2-E8 paygrades
- Source ratings – AD, AE, AM, AT
- UAV Systems Administrator, NEC 83XC
- Secondary NEC *
- Formal training
- E5-E8 paygrades
- Source ratings – AT (ET and FC decision pending)

* This will be a secondary NEC for the UAV Systems Technician [25]

Table 3. Navy Proposed Maintenance Manpower Requirements

QUANTITY	RATE/DESIGNATOR	TITLE
1	Chief Petty Officer	Maintenance Chief Petty Officer
5	AD	Aviation Machinist's Mate
4	AE	Aviation Electrician's Mate
4	AM	Aviation Structural Mechanic
4	AT	Aviation Electronics Technician
1	AZ	Aviation Administrationman

[25] Navy Training System Plan for the Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle, N75-NTSP-A-50-0004/D, June 2001.

V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

A. SUMMARY

This research examined actual and proposed manpower requirements for the Army and Navy MQ-8B Fire Scout Vertical Takeoff and Landing Unmanned Aerial Vehicle. The examination provided a framework to assist in better understanding the unique combinations of knowledge, skills and abilities required to train for, operate and maintain Unmanned Aerial Vehicles. An analysis of source ratings to possess Navy Education Classification codes for Unmanned Aerial Vehicles revealed that interestingly, only one NEC is open to women. Furthermore, research showed that there are numerous differences between the Navy Training Systems Plan and the Navy Enlisted Manpower & Personnel Classifications & Occupational Standards (NEOCS) relating to the rates and NECs initially developed to operate Fire Scout. Specifically, NEOCS displays rates to be used which are not eligible source ratings for the NECs for Unmanned Aerial Vehicles.

B. CONCLUSIONS AND RECOMMENDATIONS

1. Primary Research Questions

a. What is the Current Army Manpower and Training Structure for the MQ-8B Fire Scout VTUAV?

Conclusion: The current Army Fire Scout manpower structure is predominantly enlisted with one officer on the watch team. All duties from piloting to maintenance are performed by enlisted Soldiers. There are only two MOS's of varying paygrades used in the Army's Fire Scout program. This limited number of MOS's appears to provide a needed simplicity and flexibility for the program. For example, the Army combined the duties of both Internal and External Pilots into one position known as the Vehicle Operator. In addition, the Army has combined the duties of Payload Operator, Internal Pilot and External Pilot into one Military Occupation Specialty (MOS).

The Navy still maintains three separate Navy Education Classifications (NEC) for these three positions, with disparities between the source ratings required to obtain the NEC.

Recommendation: The simplicity of using only two MOS's works well for the Army by maintaining simplicity and providing sufficiently skilled operators and technicians. Adoption of a similar practice by the Navy is highly recommended, decreasing the need for job specialization and contributing to a more flexible working environment from the perspective of Fire Scout operators.

b. What is the Proposed Navy Rate and Rank Structure for the MQ-8B Fire Scout VTUAV?

Conclusion: It is not practical to determine the proposed Navy Rate and Rank structure for Pilots and Operators of the MQ-8B Fire Scout VTUAV because of key differences between the Navy Training System Plan for The Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle, and the Navy Enlisted Manpower & Personnel Classifications & Occupational Standards (NEOCS). The NEOCS lists four separate NECs that will be held by UAV Maintainers, External Pilots, Internal Pilots and Payload Operators (8361, 8362, 8363 and 8364). The Navy Training Systems Plan mentions only Mission Commanders (MC) and Air Vehicle Operators (AVO) for piloting the UAV. In the two control workstations, the first is manned by a Mission Payload Operator (MPO) and the second station by either a MC or AVO. Until a determination is made as to which guideline will be followed, an applicable Rate and Rank structure cannot be developed.

Recommendation:

- Align or modify the MQ-8B Navy Training Systems Plan and NEOCS to reflect the required NECs and Source Ratings.
- Modify NEOCS including ET and FC rates to support the Navy Training Systems Plan. Consider Operational Specialist (OS) and other rates deemed to possess the necessary occupational standards as viable source ratings for NECs.

2. Secondary Research Questions

a. What are the Operator Training Requirements for the MQ-8B Fire Scout?

Conclusion: Until the Navy Training Systems Plan and NEOCS are modified or aligned as previously discussed, determining operator training requirements cannot be formalized. However, as outlined in the Navy Training Systems Plan, all Air Vehicle Operators and Mission Commanders will be trained under Naval Aviation Training and Operating Procedures Standardization (NATOPS) General Flight and Operating Instructions, OPNAV instruction 3710.7 with qualification and certification monitored by an individual's parent squadron.

Recommendation:

- Align or modify the NEOCS and Navy Training Systems Plan to include the Occupational Standards required to operate and maintain the Fire Scout.
- Review and validate which rates should be used as source ratings for each NEC.
- Review and validate the reasons why females are not eligible for all UAV NECs with the exception of 8361.
- Develop a formal training program for AVOs, MCs and Maintainers.

b. What is the Feasibility of a Joint Army/Navy Training Program?

Conclusion: In an era where there is an increasing move to joint forces operation and training, combined with the proven success of Army's Fire Scout program in its relative infancy, it would be productive to investigate the possibility of a joint training program for Fire Scout Operators and Maintainers.

Recommendation:

- Develop a Joint Forces Training Agreement to train both Army and Navy operators and maintainers
- Create an additional training program, possibly On the Job Training (OJT) which would prepare Navy maintainers and operators for shipboard and payload differences and unique Navy mission profiles

C. AREAS FOR FURTHER STUDY AND RESEARCH

- Conduct a study to determine if it is more feasible to develop a stand-alone Navy UAV operator and maintainer school or if it's more cost effective to utilize a joint training environment. A joint training environment would potentially breed camaraderie amongst the services and other potential future Department of Defense Fire Scout users.
- Determine the reason why women are not eligible to hold NECs 8362, 8363 and 8364 for UAV Pilot and Payload Operators. If no viable reason or explanation exists, suggest opening all UAV NECs to men and women. Excluding women from the NEC creates animosity and places further challenges on manning.

LIST OF REFERENCES

Armed Services Vocational Aptitude Battery, accessed Feb 2009, available from the World Wide Web@ http://en.wikipedia.org/wiki/ASVAB.

Army MOS codes description, accessed Jan 2009, available from the World Wide Web @ http://usmilitary.about.com/od/enlistedjobs/a/arjobs.htm.

Army Regulation 611-6, Military Occupational Classification Structure Development and Implementation, accessed Feb 2009, available on the Word Wide Web @ http://www.army.mil/usapa/epubs/pdf/r611_1.pdf.

Army Regulation AR 95-23.

Autonomous Fire Scout UAV lands on ship," accessed Jan 2009, available from the World Wide Web @http://www.spacewar.com/reports/Autonomous_Fire_Scout_UAV_Lands_On_Ship.html.

Burgess, Richard R. *Fire Scout UAV is Poised as Sensor, Shooter for Littoral Combat Ship*. 2006, accessed Jan 2009 available from World Wide Web @http://www.navyleague.org/sea_power/may_04_25.php.

Chisolm, Patrick. *Learning to Fly…UAVs*, accessed Feb 2009 available from World Wide Web @http://www.military-training-technology.com/print_article.cfm?DocID=1256.

Curtin, Neal P., and Paul L. Francis. Unmanned Aerial Vehicles, Major Management Issues Facing DOD's Development and Fielding Efforts. Vol. GAO-04-530T. 2004, accessed Feb 2009 available from World Wide Web @http://gao.gov/cgi-bin/getrpt?GAO-04-530T.

DASH history, The DASH Weapon System, accessed Jan 2009, available from World Wide Web @ http://www.gyrodynehelicopters.com/dash_history.htm.

Department of Defense. Unmanned Aircraft Systems Roadmap 2005-2030. 2005.

Department of the Army Pamphlet 611-21, Military Occupational Classification and Structure, Headquarters Department of the Army, Washington DC, 22 Jan 2007.

Department of the Army. Army Unmanned Aircraft System Operations. 2006.

FCS Operational Requirements Document Version 2.0 AUG 07 FBCT Unit Reference Sheet (URS) 25 SEP 06, FCS Operational & Organizational (O&O) document.

Fire Scout MQ-8B Vertical Take-off and Landing Tactical Unmanned Aerial Vehicle, accessed Feb 2009, available from the World Wide Web @ http://www.army-technology.com/projects/firescout/.

Global Security.org. RQ-8A Fire Scout Vertical Take Off and Landing Tactical Unmanned Aerial Vehicle (VTUAV). 17 Aug 2005, accessed 16 May 2007 available from World Wide Web @http://www.globalsecurity.org/intell/systems/vtuav.htm.

Information Paper, MOS 15W Unmanned Aerial Vehicle (UAV) Operator, Aviation Proponency Office.

Military Physical Profile System – the PULHES Factors, accessed Feb 2009, available from the World Wide Web@ http://usmilitary.about.com/od/joiningthemilitary/l/blpulse.htm.

NATOPS General Flight and Operating Instructions, OPNAV Instruction 3710.7, available from the World Wide Web @ http://safetycenter.navy.mil/aviation/aeromedical/downloads/References/OPNAV%203710/3710_7t%20%20MARCH%2004.pdf.

Navy Enlisted Classification Codes, accessed Feb 2009, available on the World Wide Web, accessed Feb 2009 @ http://usmilitary.about.com/od/navynecs/a/necmenu.htm.

Navy Enlisted Manpower & Personnel Classifications & Occupational Standards, Volume II, Navy Enlisted Classifications (NEC), NAVPERS 18068F, January 2004.

Naval-Technology.com. Fire Scout - VTUAV Unmanned Aerial Vehicle, USA. accessed 6 July 2007, available from World Wide Web @http://www.naval-technology.com/project_printable.asp?ProjectID=1494.

Navy Training System Plan for the Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle, N75-NTSP-A-50-0004/D, June 2001.

Navy Training System Plan for the Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle, N75-NTSP-A-50-0004/D, June 2001.

Navy Rate Structure, accessed Feb 2009, accessed Feb 2009, available on the World Wide Web @ www.usmilitary.about.com.

Northrop Grumman. MQ-8B Fire Scout Facts, accessed Feb 2009, available from World Wide Web @http://www.is.northropgrumman.com/systems/system_pdfs/Factsheet_FireScout.pdf.

Northrop Grumman, MQ-8B Fire Scout Vertical Takeoff Unmanned Aerial Vehicle, accessed Jan 2009, available from the World Wide Web @ http://www.irconnect.com.

Northrop Grumman. Unmanned Systems, RQ-8B Fire Scout Vertical Takeoff and Landing Tactical Unmanned Air Vehicle Brochure, accessed Jan 2009, available from World Wide Web @ http://www.is.northropgrumman.com/systems/system_pdfs/FSN_DS.pdf.

Schweizer 330 photo, accessed Jan 2009, available from the World Wide Web @ http://www.aso.com/i.aso3/.

The Schweizer 330, accessed Jan 2009, available from the World Wide Web @ http://www.airliners.net/aircraft-data/stats.main?id=349.

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